

Claims

1. A chimeric protein comprising the  $\alpha$  chain or  $\beta$  chain of an integrin and the heavy chain or light chain of an immunoglobulin.

2. A chimeric protein heterodimer complex, characterized in that a chimeric protein stated in claim 1 comprising the  $\alpha$  chain of an integrin and the heavy chain or light chain of an immunoglobulin and a chimeric protein stated in claim 1 comprising the  $\beta$  chain of the integrin and the heavy chain or light chain of the immunoglobulin are associated with each other.

3. A chimeric protein heterodimer complex, according to claim 2, wherein the chimeric proteins stated in claim 1 are associated with each other in any of the following combinations (1), (2) and (3):

(1) An  $\alpha$  chain-immunoglobulin heavy chain- $\beta$  chain-immunoglobulin heavy chain chimeric protein heterodimer complex, in which a chimeric protein comprising the  $\alpha$  chain of an integrin and the heavy chain of an immunoglobulin and a chimeric protein comprising the  $\beta$  chain of the integrin and the heavy chain of the immunoglobulin are associated with each other.

(2) An  $\alpha$  chain-immunoglobulin heavy chain- $\beta$  chain-immunoglobulin light chain chimeric protein heterodimer complex, in which a chimeric protein comprising the  $\alpha$  chain of

an integrin and the heavy chain of an immunoglobulin and a chimeric protein comprising the  $\beta$  chain of the integrin and the light chain of the immunoglobulin are associated with each other.

(3) An  $\alpha$  chain-immunoglobulin light chain- $\beta$  chain-immunoglobulin heavy chain chimeric protein heterodimer complex, in which a chimeric protein comprising the  $\alpha$  chain of an integrin and the light chain of an immunoglobulin and a chimeric protein comprising of the  $\beta$  chain of the integrin and the heavy chain of the immunoglobulin are associated with each other.

4. A chimeric protein or a chimeric protein heterodimer complex, according to any one of claims 1 through 3, wherein the  $\alpha$  chain of an integrin is  $\alpha 1, \alpha 2, \alpha 3, \alpha 4, \alpha 5, \alpha 6, \alpha 7, \alpha 8, \alpha 9, \alpha v, \alpha L, \alpha M, \alpha X, \alpha 11b$  or  $\alpha E$ .

5. A chimeric protein or a chimeric protein heterodimer complex, according to any one of claims 1 through 3, wherein the  $\beta$  chain of an integrin is  $\beta 1, \beta 2, \beta 3, \beta 4, \beta 5, \beta 6, \beta 7$  or  $\beta 8$ .

6. A chimeric protein heterodimer complex, according to claim 2 or 3, wherein the  $\alpha$  chain of an integrin is  $\alpha 4$  or  $\alpha 2$  and the  $\beta$  chain is  $\beta 1$ .

7. A chimeric protein or a chimeric protein heterodimer complex, according to any one of claims 1 through 3, wherein the chimeric protein comprising the  $\alpha 4$  of an integrin and the

heavy chain of an immunoglobulin is identified as the amino acid sequence of sequence No. 1.

8. A chimeric protein or a chimeric protein heterodimer complex, according to any one of claims 1 through 3, wherein the chimeric protein comprising the  $\alpha 2$  of an integrin and the heavy chain of an immunoglobulin is identified as the amino acid sequence of sequence No. 19.

9. A chimeric protein or a chimeric protein heterodimer complex, according to any one of claims 1 through 3, wherein the chimeric protein comprising the  $\beta 1$  of an integrin and the heavy chain of an immunoglobulin is identified as the amino acid sequence of sequence No. 2.

10. A DNA coding for a chimeric protein stated in claim 1.

11. A DNA coding for a chimeric protein stated in claim 1, wherein the  $\alpha$  chain of an integrin is  $\alpha 1, \alpha 2, \alpha 3, \alpha 4, \alpha 5, \alpha 6, \alpha 7, \alpha 8, \alpha 9, \alpha v, \alpha L, \alpha M, \alpha X, \alpha 11b$  or  $\alpha E$ .

12. A DNA coding for a chimeric protein stated in claim 1, wherein the  $\beta$  chain of an integrin is  $\beta 1, \beta 2, \beta 3, \beta 4, \beta 5, \beta 6, \beta 7$  or  $\beta 8$ .

13. A DNA, according to claim 11, which is identified as the nucleotide sequence of sequence No. 1 or 19.

14. A DNA, according to claim 12, which is identified as the nucleotide sequence of sequence No. 2.

15. A recombinant vector, wherein a DNA stated in claim 10 is functionally linked to an expression control sequence.

16. A recombinant vector, wherein a DNA stated in claim 11 is functionally linked to an expression control sequence.

17. A recombinant vector, wherein a DNA stated in claim 12 is functionally linked to an expression control sequence.

18. A recombinant vector, wherein a DNA stated in claim 13 is functionally linked to an expression control sequence.

19. A recombinant vector, wherein the DNA stated in claim 14 is functionally linked to an expression control sequence.

20. An animal cell, comprising being transfected simultaneously by a recombinant vector in which a DNA coding for a chimeric protein comprising the  $\alpha$  chain of an integrin and the heavy chain or light chain of an immunoglobulin is functionally linked to an expression control sequence, and a recombinant vector in which a DNA coding for a chimeric protein comprising the  $\beta$  chain of the integrin and the heavy chain or light chain of the immunoglobulin is functionally linked to an expression control sequence.

21. An animal cell, according to claim 20, which is transfected simultaneously by the recombinant vectors stated in claims 16 and 17.

22. An animal cell, according to claim 20, which is transfected simultaneously by the recombinant vectors stated in claims 18 and 19.

23. A method for producing the chimeric protein heterodimer complex stated in claim 2, comprising culturing the animal

cell stated in claim 20.

24. A drug, comprising a chimeric protein or chimeric protein heterodimer complex stated in any one of claims 1 through 9.

25. A drug composition, comprising a chimeric protein or chimeric protein heterodimer complex stated in any one of claims 1 through 9.

26. A platelet substitute, comprising an isolated extracellular matrix receptor as an active ingredient.

27. A platelet substitute, according to claim 26, wherein the extracellular matrix receptor is an integrin.

28. A platelet substitute, according to claim 27, wherein the  $\alpha$  chain of an integrin is  $\alpha 1$ ,  $\alpha 2$ ,  $\alpha 3$ ,  $\alpha 4$ ,  $\alpha 5$ ,  $\alpha 6$ ,  $\alpha 7$ ,  $\alpha 8$ ,  $\alpha 9$ ,  $\alpha v$ ,  $\alpha L$ ,  $\alpha M$ ,  $\alpha X$ ,  $\alpha IIb$  or  $\alpha E$ .

29. A platelet substitute, according to claim 27, wherein the  $\beta$  chain of an integrin is  $\beta 1$ ,  $\beta 2$ ,  $\beta 3$ ,  $\beta 4$ ,  $\beta 5$ ,  $\beta 6$ ,  $\beta 7$  or  $\beta 8$ .

30. A platelet substitute, according to claim 27, wherein the integrin is integrin  $\alpha 2 \beta 1$ .

31. A platelet substitute, according to claim 26, wherein the extracellular matrix receptor is a chimeric protein heterodimer complex comprising an extracellular matrix receptor and an immunoglobulin.

32. A platelet substitute, according to claim 31, wherein the chimeric protein heterodimer complex is a chimeric protein heterodimer complex comprising an integrin and an immunoglobulin.

33. A platelet substitute, according to claim 32, wherein the chimeric protein heterodimer complex is the chimeric protein heterodimer complex stated in claim 2.

34. A platelet substitute, according to claim 33, wherein the chimeric protein heterodimer complex is the chimeric protein heterodimer complex stated in claim 6.

35. A platelet substitute, according to any one of claims 26 through 34, wherein the extracellular matrix receptor is bound to a carrier when used.

36. A platelet substitute, according to any one of claims 26 through 35, which is hemostatic.

37. A method for testing the binding between a chimeric protein heterodimer complex stated in any one of claims 2 to 9, and a ligand or cells, comprising the steps of bringing a chimeric protein heterodimer complex comprising an integrin and an immunoglobulin, and a ligand or cells into contact with each other, to prepare a mixture, and measuring the amount of the chimeric protein heterodimer complex bound to the ligand or cells or the amount of the ligand or cells bound to the chimeric protein heterodimer complex.

38. A method for searching for a substance capable of being bound to an integrin, comprising using a chimeric protein heterodimer complex stated in any one of claims 2 through 9.

39. A substance capable of being bound to an integrin, obtained by using the method stated in claim 38.

40. A method for searching for a substance which inhibits the binding between an integrin and a ligand, comprising using the method stated in claim 37.

41. A method, according to claim 40, wherein the ligand is a fibronectin fragment identified as sequence No. 3 or a collagen.

42. A protein, peptide or low molecular weight compound which inhibits the binding between an integrin and a ligand, obtained by using the method stated in claim 40 or 41.

43. A method for measuring the amount of a ligand of an integrin, comprising using a chimeric protein heterodimer complex stated in any one of claims 2 through 9.

44. A method for identifying an extracellular matrix exposed region, comprising using a chimeric protein heterodimer complex stated in any one of claims 2 through 9.

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